

**CLAIMS**

1. A metering pump system for metering and pumping a metered volume of a fluid product (2) having:-

- (a) a storage chamber (57) for storing the fluid product in;
- (b) a metering chamber (73) which is movable between a contracted state and an expanded state, wherein the system is adapted such that movement of the metering chamber from its contracted state to its expanded state results in the metering chamber being placed in fluid communication with the storage chamber to enable the metering chamber to receive an excess volume of the fluid product comprising the metered volume and a surplus volume from the storage chamber and movement of the metering chamber from its expanded state to its contracted state causes the metered volume to be pumped from the metering chamber;
- (c) a bleed mechanism (55a, 55b) for bleeding the surplus volume from the metering chamber as it moves from the expanded state to the contracted state; and
- (d) an inlet valve mechanism (150) which is disposed between the storage and metering chambers and movable between an open state, to permit flow of the fluid product from the storage chamber to the metering chamber through the inlet valve mechanism, and a closed state, to prevent flow of the fluid product between the storage and metering chambers through the inlet valve mechanism;

wherein:-

- (e) the inlet valve mechanism is adapted so that it remains in its closed state except when the metering chamber moves from the contracted state to its expanded state.

2. A metering pump system for metering and pumping a metered volume of a fluid product (2) having:-

- (a) a storage chamber (57) for storing the fluid product in;
- (b) a metering chamber (73) which is movable between a contracted state and an expanded state, wherein the system is adapted such that movement of the metering chamber from its contracted state to its expanded state results in a negative pressure being created in the metering chamber which is sufficient to

draw an excess volume of the fluid product comprising the metered volume and a surplus volume from the storage chamber into the metering chamber and movement of the metering chamber from its expanded state to its contracted state causes the metered volume to be pumped from the metering chamber;

(c) a bleed mechanism (55a, 55b) for bleeding the surplus volume from the metering chamber as it moves from the expanded state to the contracted state; and

(d) an inlet valve mechanism (150) which is disposed between the storage and metering chambers and movable between an open state, to permit flow of the fluid product from the storage chamber to the metering chamber through the inlet valve mechanism, and a closed state, to prevent flow of the fluid product between the storage and metering chambers through the inlet valve mechanism;

wherein:-

(e) the inlet valve mechanism is adapted such that the negative pressure created in the metering chamber on movement thereof from its contracted state to its expanded state is able to move the inlet valve mechanism from its closed state to its open state.

3. A metering pump system for metering and pumping a metered volume of a fluid product (2) having:-

(a) a storage chamber (57) for storing the fluid product in;

(b) a metering chamber (73) which is movable between a contracted state and an expanded state, wherein the system is adapted such that movement of the metering chamber from its contracted state to its expanded state results in the metering chamber being placed in fluid communication with the storage chamber to enable the metering chamber to receive an excess volume of the fluid product comprising the metered volume and a surplus volume from the storage chamber and movement of the metering chamber from its expanded state to its contracted state causes the metered volume to be pumped from the metering chamber and further wherein the metering chamber has at least one transfer port through which, in use, the fluid product flows from the storage chamber to the metering chamber when the metering chamber moves from its contracted state to its expanded state;

- (c) a bleed mechanism (55a, 55b) for bleeding the surplus volume from the metering chamber as it moves from the expanded state to the contracted state; and
- (d) an inlet valve mechanism (150) which is disposed between the storage and metering chambers and movable between an open state, to permit flow of the fluid product from the storage chamber to the metering chamber through the inlet valve mechanism, and a closed state, to prevent flow of the fluid product between the storage and metering chambers through the inlet valve mechanism; wherein the inlet valve mechanism:-
  - (e) is associated with an inlet port of the metering chamber; and
  - (f) is adapted in use to move from its closed state to its open state when the metering chamber moves from its contracted state to its expanded state to enable the fluid product to flow from the storage chamber into the metering chamber through the inlet port.

4. The system of claim 1 or 3 adapted such that when the metering chamber moves from the contracted state to the expanded state a negative pressure is created in the metering chamber which is sufficient to draw the fluid product from the storage chamber into the metering chamber and/or move the inlet valve mechanism from its closed state to its open state.

5. The system of any one of claims 1 to 4, wherein the metering chamber is sealed in the contracted state.

6. The system of claim 1, claim 2 or any claim appended to claim 1 or claim 2, wherein the metering chamber has at least one transfer port through which fluid product is able to be transferred from the storage chamber to the metering chamber when the metering chamber moves to its expanded state and wherein the inlet valve mechanism is not associated with the at least one transfer port.

7. The system of claim 3 or 6, wherein the metering chamber has an intermediate volumetric state between its contracted and expanded states, wherein the system is adapted such that the at least one transfer port is closed, so

that no fluid product is transferable therethrough from the storage chamber to the metering chamber, when the metering chamber moves from the contracted state to the intermediate state and wherein the inlet valve mechanism is adapted to open when the metering chamber moves from the contracted state to the intermediate state.

8. The system of claim 7 adapted such that the at least one transfer port is closed when the metering chamber moves from the intermediate volumetric state to the contracted state.

9. The system of any one of the preceding claims in which the inlet valve mechanism is adapted in use to open in an initial phase of the movement of the metering chamber from its contracted state to its expanded state.

10. The system of any one of the preceding claims in which the metering chamber has an outlet port through which the metered volume of the fluid product is pumped on movement of the metering chamber from its expanded state to its contracted state.

11. The system of claim 10 further having an outlet valve mechanism associated with the outlet port which is movable from an open state, to permit the flow of the fluid product through the outlet port, and a closed state, to prevent the flow of the fluid product through the outlet port, wherein the outlet valve mechanism is adapted so that it remains closed except when the metering chamber moves from its expanded state to its contracted state.

12. The system of claim 11 when appended to claim 7, wherein the outlet valve mechanism is only openable when the metering chamber moves from its intermediate state to its contracted state.

13. The system of claim 11 or 12, wherein the outlet valve mechanism is adapted to open in response to the hydraulic pressure in the metering chamber as it moves from the expanded state to the contracted state.

14. The system of any one of the preceding claims, wherein the bleed mechanism is adapted in use to bleed the surplus volume of the fluid product back to the storage chamber.
15. The system of claim 14 when appended to claim 3 or claim 6, wherein the bleed mechanism in use bleeds the surplus volume back to the storage chamber through the at least one transfer port.
16. The system of claim 1, claim 2 or any claim appended to claim 1 or claim 2, wherein the metering chamber has an inlet port through which the fluid product is able to flow from the storage chamber to the metering chamber and wherein the inlet valve mechanism is associated with the inlet port for opening and closing thereof.
17. The system of claim 3, any claim appended to claim 3, or claim 16, wherein the inlet valve mechanism has an inlet valve control member which is movable from a closing position, in which it closes the inlet port, to an opening position, in which it opens the inlet port.
18. The system of claim 16 or 17, wherein the inlet valve mechanism further has a biasing mechanism to bias the inlet valve control member to its closing position.
19. The system of claim 11 or any claim appended thereto, wherein the outlet valve mechanism has an outlet valve control member which is movable from a closing position, in which it closes the outlet port, to an opening position, in which it opens the outlet port.
20. The system of claim 19, wherein the outlet valve mechanism further has a biasing mechanism to bias the outlet valve control member to its closing position.

21. The system of any one of the preceding claims adapted such that when the inlet valve mechanism is moved to its open state as the metering chamber moves to its expanded state the inlet valve mechanism provides the sole flow path for the fluid product to transfer from the storage chamber to the metering chamber.
22. The system of claim 2, claim 4 or any claim appended to claim 2 or claim 4, wherein the inlet valve mechanism (i) has a biasing mechanism for biasing the inlet valve mechanism to its closed state, and (ii) is adapted such that the negative pressure created in the metering chamber on movement thereof from its contracted state to its expanded state is able to move the inlet valve mechanism from its closed state to its open state against the bias of the biasing mechanism.
23. The system of claim 22, wherein the biasing mechanism is such as to be able to return the inlet valve mechanism to its closed state as the pressure in the metering chamber increases as the fluid product flows thereinto on its movement from the contracted state to the expanded state.
24. The system of claim 3 or any claim appended thereto which is adapted such that the inlet valve mechanism opens the inlet port before the transfer port is open.
25. The system of claims 6 and 16 which is adapted such that the inlet valve mechanism opens the inlet port before the transfer port is open.
26. The system of claim 7, claim 8 or any claim appended to claim 7 or claim 8, wherein the volume of the metering chamber at its intermediate state is the same as, or substantially the same as, the metered volume.
27. The system of any one of the preceding claims in which the metering and storage chambers are isolated from one another in the contracted state of the metering chamber.
28. A fluid dispenser provided with the system of any one of the preceding claims.

29. The dispenser of claim 28 having a dispensing outlet through which the metered volume, in use, is pumped by the system.
30. The dispenser of claim 29 in which the dispensing outlet is provided in a nozzle.
31. The dispenser of claim 30 in which the nozzle is configured for insertion in a body cavity.
32. The dispenser of claim 30 or 31, wherein the nozzle is configured as a mouthpiece or nasal nozzle.
33. The dispenser of any one of claims 28 to 32 which is hand-held.
34. The dispenser of any one of claims 28 to 33 having a manually-operable actuation mechanism for actuating the metering pump system.
35. The system/dispenser of any one of the preceding claims having a rest condition in which the metering chamber is in its contracted state.
36. The system/dispenser of any one of the preceding claims containing the fluid product.
37. The system/dispenser of claim 36 in which the fluid product is a medicament.
38. A metering pump system substantially as hereinbefore described with reference to, and as illustrated by, Figures 1 to 3 and 5 or Figures 1 to 5 of the accompanying drawings.

39. A fluid dispenser substantially as hereinbefore described with reference to, and as illustrated by, Figures 1 to 3 and 5 or Figures 1 to 5 of the accompanying drawings.